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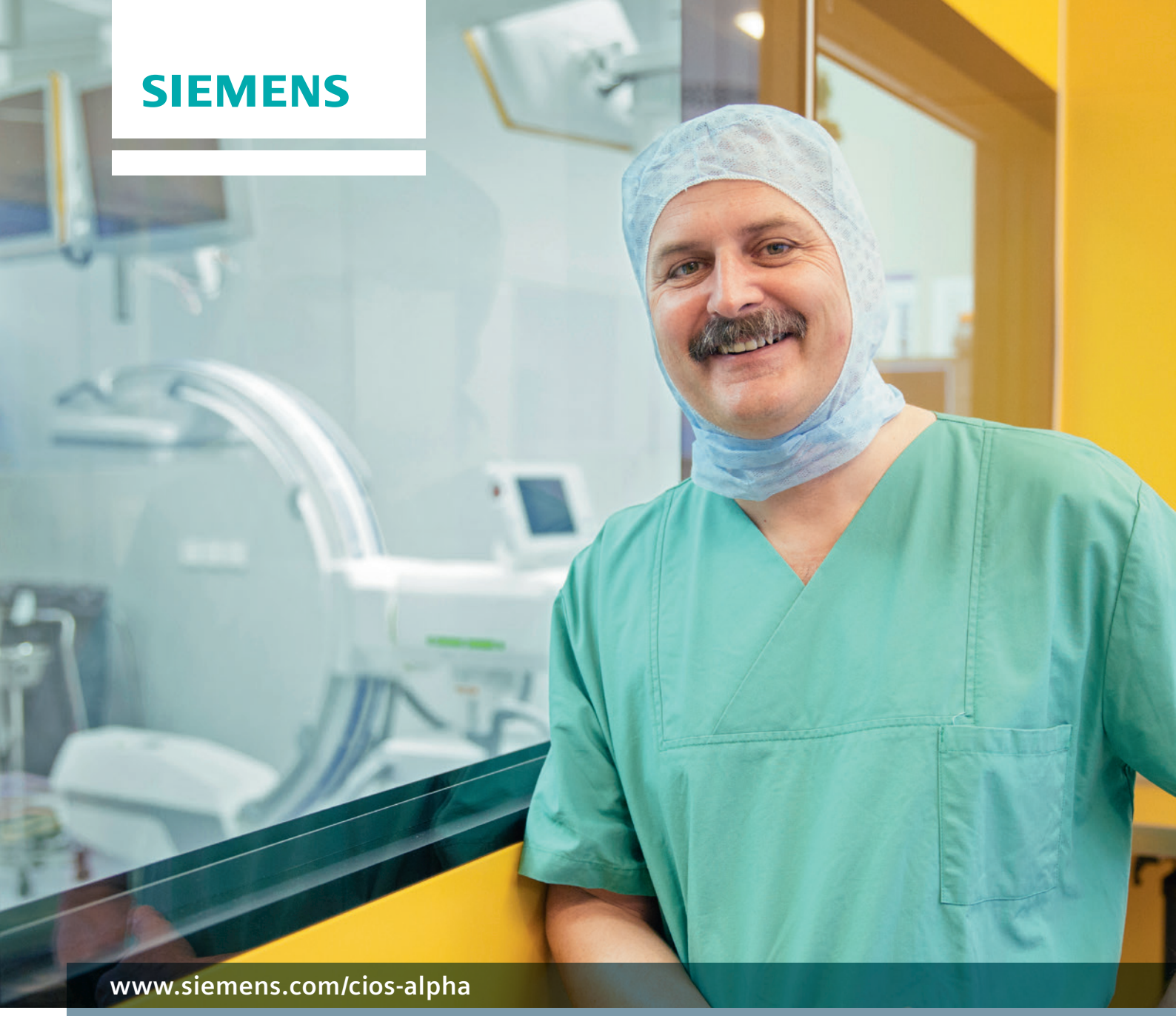

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Cios Alpha: Flat Detector Mobile C-Arm Imaging in Ortho/Trauma/Spine Surgery

Prof. Dr. med. Florian Gebhard,
University Hospital Ulm, Germany

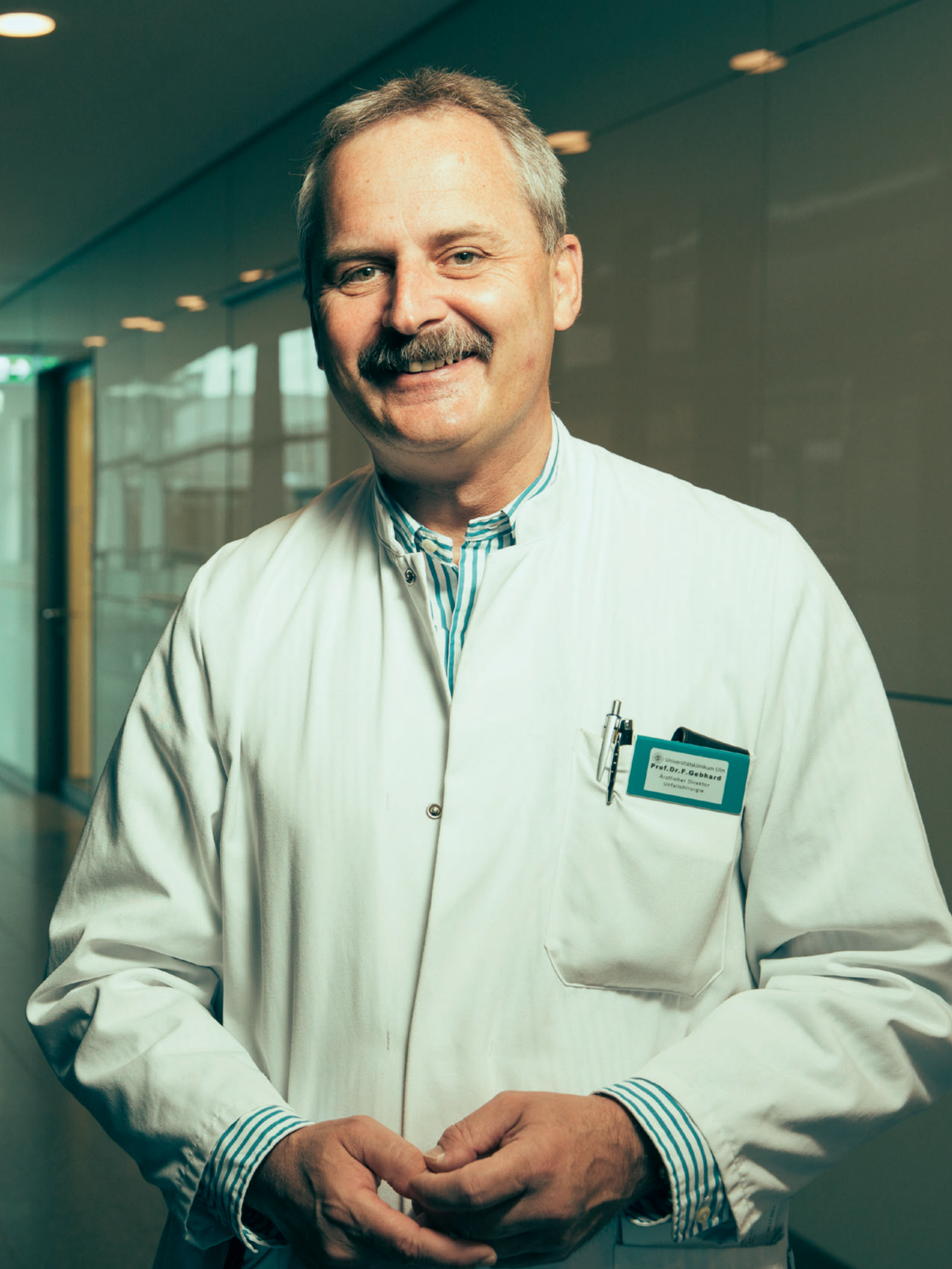
Answers for life.

More Certainty in Intraoperative Imaging

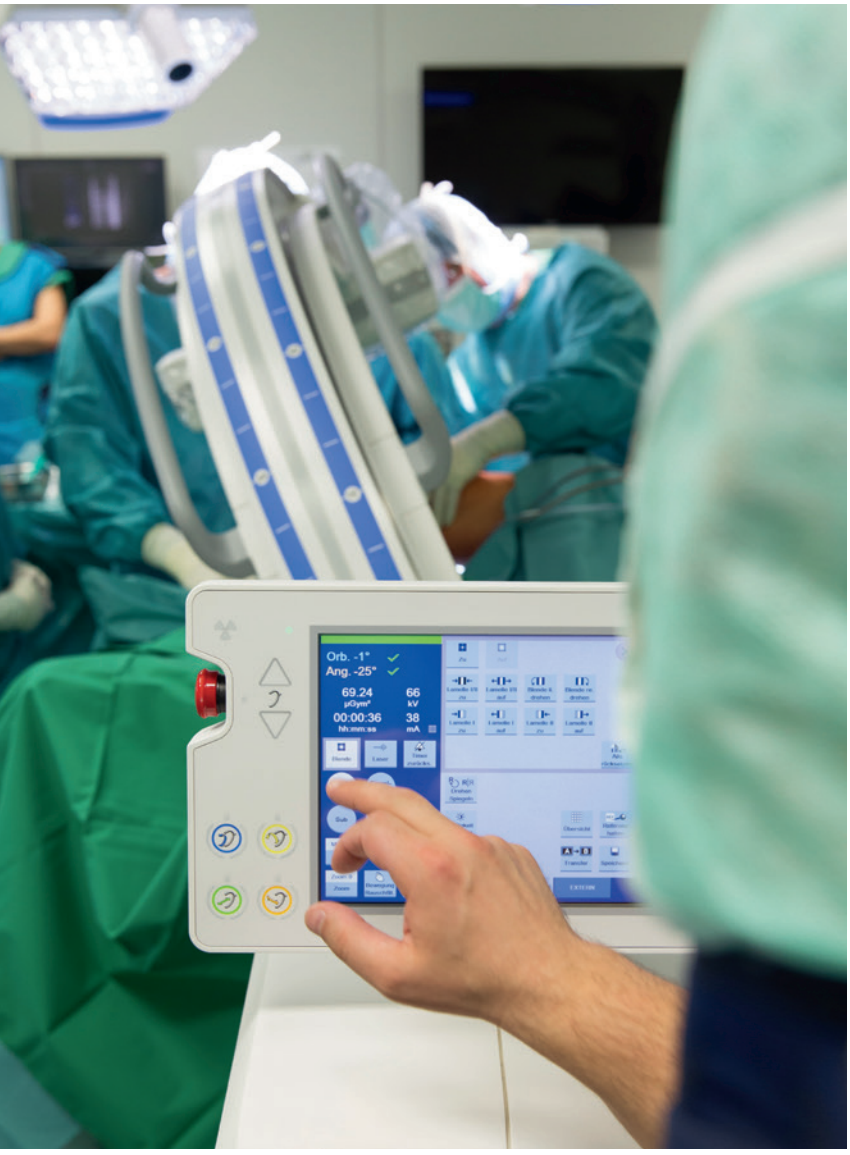
The Mobile C-Arm Cios Alpha

In minimally invasive surgery, the surgeon's view of the operation site is limited by employing techniques to conserve tissue and protect the patient. The mobile C-arm Cios Alpha provides the missing link. This intraoperative imaging system from Siemens underwent a comprehensive practical trial at the Clinic for Orthopedic Trauma, Hand, Plastic and Reconstructive Surgery at the University Hospital Ulm, Germany. In the eyes of Professor Florian Gebhard, the hospital's Medical Director, precise intraoperative imaging increases the safety and quality of surgical performance.

Text: **Matthias Manych** Photos: **Sven Doering**


Universitätsklinikum Ulm
Prof.Dr.F.Gebhard
Ärztlicher Direktor
Unfallchirurgie

While Professor Florian Gebhard restores movability to a finger with a torn tendon in one of the 15 operating rooms, his next patient is being prepared for foot surgery in the adjoining theater. A snapshot of the daily surgical routine in the traumatology and orthopedics department – diverse, challenging, painstakingly planned, yet flexible in an emergency. A total of 6,500 inpatients are treated in Ulm annually. Florian Gebhard explains: "Our focus is on fractures and joint injuries caused by industrial and sports accidents. If we include pelvic and spinal injuries, these comprise 60 percent of the injuries we treat. The remaining 40 percent constitute degenerative diseases as late complications of an injury, and our specialist field of oncological surgery for the treatment of tumors of the skeletal system." Within this spectrum of differing demands and workflows, intraoperative imaging must be effective, user-friendly, and naturally also capable of merging smoothly into working procedures without compromising optimal image quality.



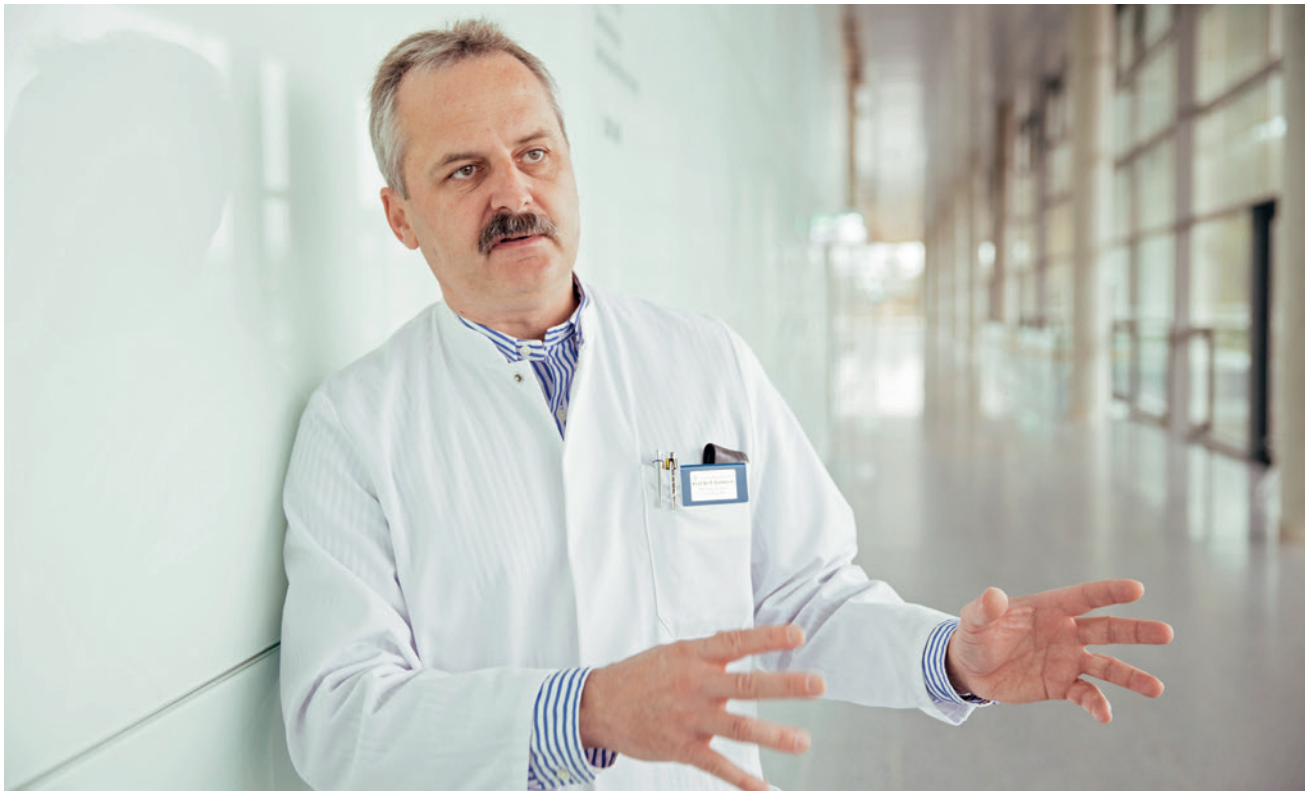
Intra-operative imaging with Cios Alpha is effective, user-friendly, and merges smoothly with working procedures without compromising image quality.

The demands placed on a mobile C-arm are high, and result, on the one hand, from the trend towards minimal invasiveness, according to the Medical Director in Ulm: "All advances in tissue-conserving surgery – smaller incisions, faster rehab capacity, and increased flexibility – require imaging, as I need to replace the dimension I no longer see directly." On the other hand, more specialized implants which meet the individual anatomical requirements can be used. For long-term success, these implants must be positioned with extreme precision. This requires intraoperative imaging to produce high-detail resolution in the millimeter range. Maximum precision also requires the closure of fractured articular surfaces. In order to avoid notches in the joints and thus cartilage defects, no gaps may be visible in the intraoperative X-ray image after the repair is complete.

From Snow Flurries to Brilliance

Cios Alpha meets these demands with its flat detector, which has a resolution of 1.5 k by 1.5 k. In addition, the field of view now covers 30 times 30 centimeters, which is 25 percent larger than conventional image intensifiers. The 25-kilowatt generator further allows for high image resolution even in case of very obese patients. When he started his surgical career in 1985, Florian Gebhard was accustomed to viewing low-contrast, blurry C-arm images, whose quality he compares to a snow flurry. The evolution of mobile intraoperative imaging equipment

Imaging with Cios Alpha



“We are now approaching the quality of a radiological X-ray image in the field of intraoperative imaging.”

Prof. Dr. med. Florian Gebhard, Medical Director, Clinic for Orthopedic Trauma, Hand, Plastic and Reconstructive Surgery at the University Hospital Ulm, Germany

Professor Gebhard, how significant is intraoperative imaging in your field?
Gebhard: In our endeavors to make operating techniques more tissue conserving, implants are available which can be inserted via smaller incisions, for example. As a result, all minimally invasive procedures in the fields of traumatology and orthopedics are extremely reliant on intraoperative imaging. In addition, it is also possible to bid farewell to large-scale lines of incision and make these more “intelligent”, even in the case of more major interventions.

What makes Cios Alpha so attractive in your opinion?
Gebhard: With normal C-arms, I need to communicate all operating instructions to the unsterile operating staff, which sometimes results in misunderstandings. So the question is how surgeons can control intraoperative X-ray systems even more effectively themselves. With its memory functions, motorization and remote user interface directly at the operating table, Cios Alpha enables us to control almost everything independently.

How do patients benefit from Cios Alpha?
Gebhard: With its image control functions and high detector resolution, which allows improved intraoperative imaging, patients benefit overall from the increased safety and quality of our work.

attains a standard of quality in Cios Alpha's state-of-the-art system which the Professor terms as "brilliant".

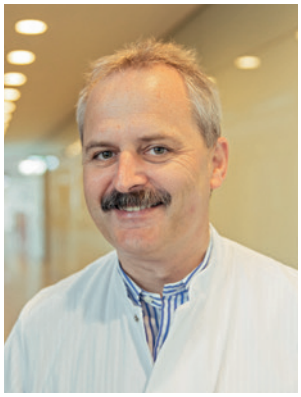
In the clinical testing phase, the mobile C-arm generated razor-sharp images of fracture treatments in all skeletal areas and of all forms of spinal surgery. Although all these were routine interventions, they were selected to challenge the performance of the C-arm, as were spinal operations on patients suffering from osteoporosis and, particularly, images of children with injuries to or near the growth plate. The identification of the epiphyseal plate requires exceptionally high levels of resolution and contrast. "I also asked our visiting surgeons and they commented that it resembled a preoperative diagnostic X-ray image," reports Gebhard, emphasizing: "This means we are now approaching the quality of a radiological X-ray image in the field of intraoperative imaging."

Innovative Image Field and Collimation Concept

Cios Alpha offers an innovative collimation system which allows for image sections to be focused optimally onto the relevant region and also increases the image quality. While the concentric images generated by previous generations of C-arms only permitted a relatively small section of bone to be viewed, longer tracts can now be displayed, in order to control extremity axes and to prevent incorrect positioning, for example. The asymmetric collimation feature also captures marginal structures which would otherwise lie outside the symmetric image, as Cios Alpha permits the cropping of the rectangular image from all directions, similar to digital photo editing. This often eliminates the need for a change in the patient's position, and the image quality is improved by fading out undesirable elements, such as

Precise intraoperative imaging increases the safety and quality of surgical procedures, according to Prof. Florian Gebhard of the University Hospital Ulm, Germany.

Professor Dr. med. Florian Gebhard



Professor Gebhard has been employed at the University Hospital Ulm since 1996, where he was appointed Assistant Medical Director in 2001 and subsequently Medical Director of the Clinic for Orthopedic Trauma, Hand, Plastic and Reconstructive Surgery in 2007. In addition, he holds the post of Executive Director of the Center for Surgery at the University Hospital. The surgeon has been involved in the AO Foundation (Association for the Study of Internal Fixation) as a member of an expert panel for computer-assisted operating techniques for twelve years. In June 2013, Gebhard was appointed to the post of Expert for Trauma within the Supervisory Board of the AO Foundation. Besides general traumatology, his clinical focus lies principally on spinal and pelvic surgery. As regards imaging, 3D-supported techniques are his chief interest. His research is concerned with the treatment of fractures caused by osteoporosis in old age and the identification and mode of functioning of blood parameters in polytraumatized patients.

those produced via the metal of the operating table. In the eyes of Professor Gebhard, this is an excellent tool which proves highly useful in many situations. Additionally, the image can be rotated until it matches the bone's position within the patient.

Decisive Improvements to Operability and Workflow

It goes without saying that the level of imaging capable with Cios Alpha and the safety it provides in terms of permitting the clear recognition of all important structures improves surgical work considerably. In Professor Gebhard's view, another fundamental achievement is that the equipment allows him to guide and control the intraoperative imaging process himself. Operators now use a touch screen at the operating table to control the image directly from the sterile area, and have everything within easy reach. If they wish to fade out soft tissue in favor of bone structures, for example, they need only alter the radiation dose and gray tones on the touch screen. Professor Gebhard's verdict on this working method: "The control system is now more intelligent." Control keys on the flat detector also permit surgeons to maneuver the C-arm into the desired position quickly and easily without requiring aid from third parties. Additionally, if the overall system does not have to be moved during the intervention, as is the case with operations on hand and ankle joints or the spine, the C-arm can return to a saved position at the mere touch of a button.

According to the experiences of the Ulm-based team, Cios Alpha's diverse features have resulted in significant improvements to surgical workflows. Says Florian Gebhard: "I find it a more elegant, relaxed way of working which reduces operation times." The system is also suitable for use with all surgeries which can be supported intraoperatively via a mobile 2D-C-arm – a criterion which applies to all standard interventions at the University Hospital Ulm.

Matthias Manych, a biologist, is a freelance scientific journalist, editor, and author specializing in medicine. His work appears primarily in specialized journals, but also in newspapers and online.

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State-of-the-art patient care: The new Center for Surgery in Ulm was inaugurated in 2012.

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